CLAIMS

What is claimed is:

1. A transfer unit for use with a form, fill and seal packaging machine, the transfer unit configured for receiving a partially erected carton from a first station in a tubular form and for conveying the carton in the tubular form to a second station, and for conveying the carton from the second station to a third station, the transfer unit comprising:

a hub defining a longitudinal hub axis, the hub configured for rotational movement about the hub axis;

at least one car mounted to the hub for longitudinal movement along the hub generally parallel to and spaced from the hub axis, the at least one car having first and second mandrels mounted thereto, each mandrel configured to receive a partially erected carton, each mandrel having a mandrel axis perpendicular and tangential to the hub axis;

means for rotationally moving the hub about the hub axis; and

means for longitudinally moving the car along the hub;

wherein the hub rotates through a series of stations, a first station at which the car is at a first longitudinal position and a carton is loaded on to the first mandrel, the car moves longitudinally and a carton is loaded on to the second mandrel, and wherein the hub rotates to a second station.

2. The transfer unit in accordance with claim 1 including a pair of cars mounted to the hub in longitudinal alignment with one another and mounted to the hub for longitudinal movement with one another.

3. The transfer unit in accordance with claim 1 wherein the mandrels are rotational about their respective mandrel axes and including means for rotationally moving the mandrels about their respective axes, about 90 degrees, between an untwisted position and a twisted position.

4. The transfer unit in accordance with claim 3 wherein the means for longitudinally moving the cars and the means for rotationally moving the mandrels are operably connected to one another.

5. The transfer unit in accordance with claim 1 wherein the means for longitudinally moving the car includes a car drive having a continuous element disposed about a pair of shafts for rotation about the shafts, the element defining a pair of opposingly moving sides.

6. The transfer unit in accordance with claim 5 wherein the car is mounted to one side of the element and including a second car mounted to the opposing side of the element, and wherein rotation of the element effects opposing movement of the cars toward one another or away from one another.

7. The transfer unit in accordance with claim 5 wherein one of the pair of shafts is a driven shaft and the other is an idler shaft, the driven shaft being operably connectable to a drive receiver for rotating the shaft.

8. The transfer unit in accordance with claim 7 including a T-drive mounted to the driven shaft and received in the drive receiver for rotating the shaft.

9. The transfer unit in accordance with claim 8 including an interlock ring disposed at a longitudinal end of the hub, the interlock ring having a fixed portion, wherein the drive receiver is disposed along a path defined by the interlock ring and forming a portion of the path, and wherein the T-drive is configured for traversing along the interlock ring and into the drive receiver.

10. The transfer unit in accordance with claim 2 wherein the car is mounted to a rail on the hub for longitudinal movement along the hub.

11. The transfer unit in accordance with claim 3 wherein the car includes a toggle for operably connecting the mandrels of the car with one another, the toggle configured to simultaneously rotate the operably connected mandrels about their respective axes.

12. The transfer unit in accordance with claim 11 including stops, operably connected to the toggles to position the mandrels at the twisted and untwisted positions.

13. The transfer unit in accordance with claim 9 including an interlock rod operably connected to the car and cooperating with the interlock ring, the rod and ring including notches and slots that align with one another to permit rotation of the hub about the hub axis when the car is in a proper position and to misalign with one another to interfere with rotation of the hub when the car is in an other than proper position.

14. The transfer unit in accordance with claim 2 including four car pairs, each of the pairs mounted 90 degrees from its adjacent car pairs.

15. The transfer unit in accordance with claim 14 wherein the hub is configured for rotational movement through four quadrants, and wherein each of the car pairs resides in a respective quadrant.

16. A transfer unit for use with a form, fill and seal packaging machine, the transfer unit configured for receiving a partially erected carton from a first station in a tubular form and for conveying the carton in the tubular form to a second station, and for conveying the carton from the second station to a third station, the transfer unit comprising:

a hub defining a longitudinal hub axis, the hub configured for rotational movement about the hub axis;

a plurality of car pairs mounted to the hub, each of the car pairs mount to the hub along a rail for longitudinal movement along the hub generally parallel to and spaced from the hub axis, each of the car pairs including first and second cars, each of the cars having first and second mandrels mounted thereto, each mandrel configured to receive a partially erected carton, each mandrel having a mandrel axis and being rotational about its respective mandrel axis, each mandrel axis being perpendicular and tangential to the hub axis;

a first drive operably connected to the hub for rotating the hub;

a second drive for longitudinally moving the car pairs along the hub; and

a link assembly actuated by longitudinal movement of the car pairs for twisting the mandrels about their respective mandrel axes, about 90 degrees, between an untwisted position and a twisted position,

wherein the hub rotates through four discrete stations, a first station at which the cars are at a first longitudinal position and cartons are loaded on to the first mandrels of the first and second cars, the first and second cars move longitudinally and cartons are loaded on to the second mandrels of the first and second cars, the first and second cars move further longitudinally and the first and second mandrels of the first and second cars move from the untwisted position to the twisted position.

17. The transfer unit in accordance with claim 16 wherein the second drive includes a continuous belt disposed about a pair of shafts for rotation about the shafts, the belt defining a pair of opposingly moving sides, and wherein one of the cars is mounted to one side of the belt and the other car is mounted to the opposing side of the belt, and wherein rotation of the belt effects opposing movement of the cars toward one another or away from one another.

18. The transfer unit in accordance with claim 17 wherein one of the pair of shafts is a driven shaft and the other is an idler shaft, the driven shaft being operably connectable to a drive receiver for rotating the shaft.

19. The transfer unit in accordance with claim 18 including a T-drive mounted to the driven shaft and received in the drive receiver for rotating the shaft.

20. The transfer unit in accordance with claim 19 including an interlock ring disposed at a longitudinal end of the hub, the interlock ring having a fixed portion, wherein the drive receiver is disposed along a path defined by the interlock ring and forming a portion of the path, and wherein the T-drive is configured for traversing along the interlock ring and into the drive receiver.

21. The transfer unit in accordance with claim 16 wherein each car includes a toggle for operably connecting the mandrels of each car with one another, the toggles configured to simultaneously rotate the operably connected mandrels about their respective axes.

22. The transfer unit in accordance with claim 21 including stops, operably connected to the toggles to position the mandrels at the twisted and untwisted positions.

23. The transfer unit in accordance with claim 20 including an interlock rod operably connected to each car pair and cooperating with the interlock ring, the rod and ring including notches and slots align with one another to permit rotation of the hub about the hub axis when the cars are in a proper position and to misalign with one another to interfere with rotation of the hub when the cars are in an other than proper position.

24. The transfer unit in accordance with claim 17 including four car pairs, each of the pairs mounted 90 degrees from its adjacent car pairs.

25. The transfer unit in accordance with claim 24 wherein the hub is configured for rotational movement through four quadrants, and wherein each of the car pairs resides in a respective quadrant.

26. An unloader for use with a form, fill and seal packaging machine having a transfer unit, the form, fill and seal packaging machine configured to receive a partially erected carton having a closure formed thereon on a turret mandrel, the transfer unit configured for receiving a partially erected carton from a first station in a tubular form and for conveying the carton in the tubular form to a second station for molding the closure thereon, and for conveying the carton from the second station to an unload station for moving the carton to the turret mandrel, the unloader comprising:

a frame;

a pair of rotating elements mounted to the frame;

a drive operably connected to one of the pair of rotating elements;

a belt positioned around the rotating elements for rotation with the elements;

a finger operably connected to the belt for engaging the carton at the unload station and for moving the carton from the transfer unit to the turret mandrel.

27. The unloader in accordance with claim 26 wherein the finger reciprocates.

28. The unloader in accordance with claim 26 wherein the rotating elements are wheels.

29. The unloader in accordance with claim 28 wherein the wheels having different diameters.

30. A drive assembly for longitudinally moving a pair of carrier elements along a hub having a longitudinal axis and rotating about the longitudinal axis, the drive assembly comprising:

a frame;

a rail disposed longitudinally along the hub and spaced from the longitudinal axis, the rail configured to carry the carrier elements;

a ring fixedly mounted to the frame and disposed about the hub, the ring defining a track and including a stationary portion and a rotating portion, the rotating portion being operably connected to a drive;

first and second rotating shafts disposed on the hub, longitudinally spaced from and aligned with one another, the first shaft being a driven shaft and including a head portion disposed at and guided by the ring, the second shaft being an idler shaft;

a continuous, flexible element disposed about the first and second shafts for rotational movement about the shafts, the flexible element, disposed about the shafts, defining opposing elongate sides and return portions at the shafts, the carrier elements being mounted to the flexible element; and

a drive mounted to the frame and operably connected to the ring rotating portion for rotating the ring rotating portion,

wherein the head portion, traverses along the ring track into the rotating ring portion and is engaged and rotated by the rotating ring portion and wherein rotation of the head portion rotates the flexible element to move the carrier elements along the rail.

31. The drive assembly in accordance with claim 30 wherein the carrier elements are mounted to respective opposing sides of the flexible element and

wherein rotation of the element in a first direction drives the carrier elements toward one another and wherein rotation of the element in a second direction drives the carrier elements away from one another.

32. The drive assembly in accordance with claim 30 wherein rotation of the flexible element drives the carrier elements in opposing directions from one another.

33. The drive assembly in accordance with claim 30 including rollers mounted to the head portion for traversing along the track.

34. The drive assembly in accordance with claim 30 wherein the ring includes two rotating portions disposed 180 degrees from one another and wherein the head portion is rotated in a first direction at one of the rotating portions and is rotated in a second, opposite direction in the other rotating portion.

35. A drive assembly for effecting movement of an effected element mounted to a hub having a longitudinal axis, the hub configured for rotating about the longitudinal axis, the drive assembly comprising:

a frame;

a ring fixedly mounted to the frame and disposed about the hub, the ring defining a track and including a stationary portion and a rotating portion, the rotating portion being operably connected to a drive;

first and second rotating members disposed on the hub, longitudinally spaced from and aligned with one another, the first member being a driven member and including a head portion disposed at and guided by the ring, the second member being an idler member;

a continuous, flexible element disposed about the first and second members for rotational movement about the members, the flexible element, disposed about the members, the effected element being operably connected to the flexible element; and

a drive mounted to the frame and operably connected to the track rotating portion for rotating the track rotating portion,

wherein the head portion traverses along the ring track into the rotating track portion and is engaged and rotated by the rotating track portion and wherein rotation of the head portion rotates the flexible element to move the effected element.

36 The drive assembly in accordance with claim 30 wherein the effected element is a car.

37. The drive assembly in accordance with claim 31 including a pair of cars each being mounted to opposing sides of the flexible element for opposing movement therewith.